Preface

Designing a range of sensors has enormous impact in current era. Fundamental issues towards the incorporation of sensing platform include the demand for low costs and have potential for real time measurement. With significant achievements in the nanoscience and nanotechnology, nanomaterials-based sensing amplifications have enormous potential for improving both selectivity and sensitivity of sensors. The selectivity of a sensor mostly relies on the specificity of interaction between receptors and analytes. However, the sensitivity, stability, selectivity, response time and the detection limit of sensors strongly depends on the physicochemical properties of the transducer, which can be improved by the combination of nanomaterials at the interface between transducer and receptors.

The growing demand for cost-effective, simple, rapid, and portable screen in methods for the qualitative and quantitative determination of analytes relevant to medical research, clinical diagnosis, environment and food safety monitoring, and biosecurity investigation has been accelerated the development of nanomaterials based sensors. Metal nanomaterials are different from their bulk counterparts since the catalytic property originates due to their quantum-size dimensions. The artificial enzymes or catalytically active nanomaterials and nanocoordination polymers show numerous advantages over the natural enzymes, like controlled synthesis, high stability against harsh conditions, tunability in catalytic activities, low cost etc. Nanomaterials and coordination polymers are a good substitution candidate of the natural enzymes and act as a catalyst in catalysis and sensing. However, bio-mimic catalysts and sensing using artificial enzymes are less explored and reported in the literature for development of stable and low cost sensors. Currently, optical, electrochemical, mass sensitive sensors are being used for detection of different biomolecules. Though, these techniques suffer from the lack of stability, poor detection limit and requiring high amount of analytes.

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Colorimetric detection based on nanomaterials and coordination polymer is showing potential for screening large number of samples. Fast and low cost sensors for toxic chemicals and biologically important analytes have massive demand. Considering these facts and futuristic applications of nanomaterials and coordination polymers in bio-mimic and sensors, the broad objectives of the thesis work:

• To synthesize metal nanomaterials, nanocomposites and nanocoordination polymers for simple and low cost biomimic catalysts and sensors and their characterization by using various techniques.

• To explore the outstanding physical, chemical and catalytic properties of nanomaterials and nano-coordination polymers for catalysis and sensing of biomolecules (glucose, choline), hazardous analytes (picric acid) and drug (6-mercaptopurine) and developing portable sensing kits for early and accurate detection of different analytes of interest. Based on above objectives, this thesis work is divided into eight chapters as follows.

Chapter 1 gives a general idea and an introduction to basic concepts about sensors, components, types of sensors, importance of nanomaterials, their composites, coordination polymers and metal nanomaterials for catalysis and sensing, nanomaterials and coordination polymers used as artificial enzyme which substitute natural enzymes. Therefore there is a need to develop sensitive and selective sensor for detection of biomolecules, hazardous molecules, life saving drugs and their portability. The related literature survey is also listed.

Chapter 2 describes different experimental techniques which have been used for the characterizations of developed materials.

Chapter 3 contains the synthesis and characterization of gold nanoparticles (AuNPs) decorated over MoS_2 quantum dots (AuNPs@MoS_2-QDs). Further used as a robust

peroxidase- mimetic for instant unaided eye detection of glucose in serum, saliva and tear by developed portable test kit.

Chapter 4 deals with synthesis and characterization of nanoporous palladium(II) bridged coordination polymer acting as a peroxidase mimic for visual detection of glucose in serum, tear and saliva by designed portable test kit.

Chapter 5 describes synthesis and characterization of gold nanoparticles (AuNPs) decorated over WS_2 quantum dots (AuNPs@WS_2-QDs) as a peroxidase mimetic for visual detection of choline in milk and serum.

Chapter 6 includes synthesis and characterization of silver nanoparticles modified with 4-amino-3-hydrazino-5-mercapto-1,2,4-triazole for colorimetric detection of picric acid.

Chapter 7 deals synthesis and characterization of Nano network of coordination polymer AHMT-Ag for the effective electrochemical detection of 6-mercaptopurine in urine and blood serum.

Chapter 8 includes conclusion of the thesis work and future prospects of the work.